

Fishery Data Series No. 91-20

Distribution and Relative Abundance of Stocked Species in Harding Lake, 1987-1990

by

**Tim Viavant
and
John H. Clark**

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Alaska Department of Fish and Game

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ABSTRACT

Enhancement efforts at Harding Lake in the past 10 years have involved stocking inconnu or sheefish *Stenodus leucichthys*, rainbow trout *Oncorhynchus mykiss*, Arctic char *Salvelinus alpinus*, sockeye salmon *Oncorhynchus nerka*, Arctic grayling *Thymallus arcticus*, and lake trout *Salvelinus namaycush*. As part of the evaluation of the success of these introductions, Harding Lake was fished with fyke traps and gill nets for several net-nights during each month of the ice-free season in 1987 and again in 1990, and during some months of the ice-free seasons of 1988 and 1989. Fishing effort took place in several ecological zones: shallow littoral, deep littoral, shallow benthic, moderate benthic, deep benthic, and pelagic. Resultant catches of fish were considered low in most zones for most species. Catch-per-net-night of fishing effort was highest for northern pike in the shallow and deep littoral zones, highest for burbot and least cisco in the pelagic zone, and highest for Arctic char and lake trout in the various benthic zones. Catches were zero for rainbow trout, Arctic grayling, and sockeye salmon during almost all sample periods in most zones. Of all introductions made into Harding Lake during recent years, Arctic char stocked as juveniles or adults have been the most successful. Recent introductions of adult rainbow trout appear successful. In almost all cases, fish stocked smaller than 10 grams into Harding Lake have not been detected in appreciable numbers in sampling gear, because survival of these fish has been negligible.

KEY WORDS: Harding Lake, enhancement, stocking evaluation, sheefish, inconnu, *Stenodus leucichthys*, rainbow trout, *Oncorhynchus mykiss*, Arctic char, *Salvelinus alpinus*, sockeye salmon, *Oncorhynchus nerka*, Arctic grayling, *Thymallus arcticus*, lake trout, and *Salvelinus namaycush*.

INTRODUCTION

Harding Lake is the largest road accessible lake within 100 km of Fairbanks, the major population center of interior Alaska (Figure 1). While a great deal of non-fishing recreation occurs at Harding Lake, angling has traditionally been considered poor. The lake supports far fewer angler-days per hectare of water than several other smaller lakes in the vicinity. Fish species indigenous to Harding Lake include northern pike *Esox lucius*, burbot *Lota lota*, least cisco *Coregonus sardinella*, and slimy sculpin *Cottus cognatus*. Because of its size, proximity to users, and high level of recreational use, Harding Lake has the potential to provide a much larger recreational fishery than it currently does. It has been a goal of the Department of Fish and Game (ADFG) to provide better angling at Harding Lake for over 20 years, and fish stocking has been used as a tool to accomplish this goal since statehood.

Adult lake trout *Salvelinus namaycush* were introduced into Harding Lake in the 1960's. A relatively small reproducing population resulted from this introduction and a small fishery for lake trout has developed. Enhancement efforts involving the stocking of coho salmon *Oncorhynchus kisutch* in the 1970's and inconnu or sheefish *Stenodus leucichthys* in the 1980's failed to create significant fisheries for these species. More recent stocking efforts included rainbow trout *Oncorhynchus mykiss*, Arctic char *Salvelinus alpinus*, sockeye salmon *Oncorhynchus nerka*, Arctic grayling *Thymallus arcticus*, and lake trout (Table 1). These efforts mostly involved stocking fingerlings or fry, and for the most part have not resulted in substantial increases in harvest (Table 2). Recently, enhancement efforts have included stocking catchable-sized Arctic char and rainbow trout. These fish have been caught in relatively large numbers during test fishing with hook and line gear, and have showed up to some extent in the recreational harvest (Table 2).

Previous stocking efforts have been evaluated by periodic test netting at various locations and depths. Most of these efforts were not systematic or consistent. As stocking efforts at Harding Lake have increased to include more species and larger sized fish, it was decided that these introductions should be evaluated more closely to provide guidance for future enhancement efforts. The objective of this study (F-10-6, E-3-1d) was to document the presence of stocked Arctic char, rainbow trout, lake trout, and Arctic grayling in different zones of Harding Lake on a monthly basis during the ice-free season. This report summarizes information on distribution and relative abundance of stocked species in Harding Lake as determined through systematic test netting efforts conducted from 1987 through 1990. Other recent evaluations have included creel surveys (Merritt, et al. 1990 and Hallberg and Bingham pers. comm.¹), angling evaluations (Viavant pers. comm.²), and tow netting (Clark and Doxey 1988 and Clark 1991). Also, Doxey (1991) has recently provided a historical assessment of these enhancement efforts.

¹ Hallberg, J. and A. Bingham. 1991. Personal Communication. ADFG, Division of Sport Fish, 1300 College Road, Fairbanks, Alaska 99701.

² Viavant, Tim. 1991. Personal Communication. ADFG, Division of Sport Fish, 1300 College Road, Fairbanks, Alaska 99701.

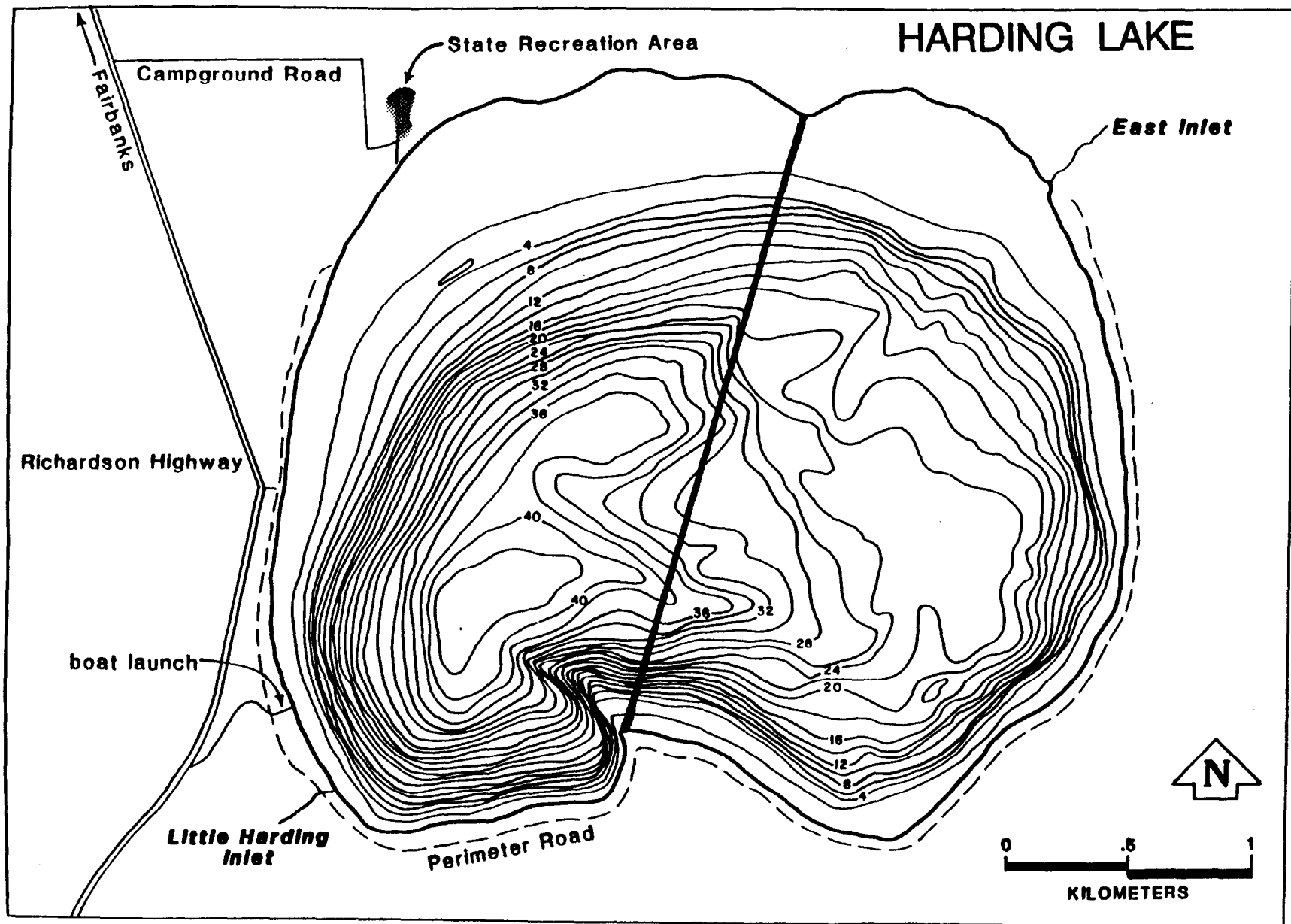


Figure 1. Contour map of Harding Lake in 2 meter intervals and access locations.

Table 1. Fish stocked into Harding Lake since 1986.

Species and size ^a of fish stocked		Number of fish stocked				
		1986	1987	1988	1989	1990
Sheefish	Fry	0	0	60,000	109,503	0
	Fingerling	88,460	239,640	0	0	0
	Adult	0	35	0	0	0
Rainbow trout	Fry	0	544,200	0	0	0
	Fingerling	187,485	582,021	248,658	193,757	300,000
	Adult	0	0	0	0	11,500
Arctic char	Juvenile	0	0	30,770	12,635	101,294
	Adult	0	0	0	48,772	1,312
Arctic grayling	Fry	0	640,000	1,169,806	0	30,000
	Fingerling	79,412	0	0	0	35,000
Lake trout	Fingerling	0	0	0	0	72,000
Sockeye salmon	Fry	0	0	500,000	500,000	400,000

^a Fish sizes are defined as follows: fry < 1.0 g, fingerling ≥ 1.0 g and < 10 g, juvenile ≥ 10 g and < 90 g, adult ≥ 90 g.

Table 2. Angler effort and harvest of wild and stocked fish, Harding Lake, Alaska, 1986 - 1989^a.

	Year			
	1986	1987	1988	1989
Number of days fished	2,064	5,125	3,256	4,935
Number of anglers	1,590	3,371	2,599	2,976
Number of fish harvested				
Arctic char	0	0	0	141
Arctic grayling	0	79	0	0
Burbot	0	53	73	10
Lake trout	24	0	55	119
Northern pike	673	1,886	2,092	1,764
Rainbow trout	0	118	73	456
Sheefish	0	0	73	0

^a Data from Mills (1987, 1988, 1989, 1990).

METHODS AND MATERIALS

For purposes of sampling, Harding Lake was divided into three ecological zones: littoral, benthic, and pelagic. The littoral zone was subdivided by depth into shallow (1 m) and deep (10 m); and the benthic zone was subdivided into shallow (15 m), moderate (21 m), and deep (27 m). Thus, sampling of Harding Lake occurred in a total of six zones, differentiated by ecology and depth. This sampling scheme was created because it was thought to resemble the distribution habits of fish present in Harding Lake. For example, *a priori* information indicated that least cisco are primarily present in the pelagic zone; Arctic char, burbot and lake trout are primarily in the benthic zone; and northern pike, rainbow trout and Arctic grayling are primarily in the littoral zone. Subdivisions by depth assured that sampling effort was dispersed equally throughout each ecological zone.

Four fyke traps were fished in the shallow littoral zone, and one sinking gill net was fished in the deep littoral zone for four net-nights during each month of the ice-free season (Table 3). Fyke traps had a 25 m center lead and two 7.5 m wings. Sinking, variable mesh, 40 m by 2 m gill nets were fished perpendicular to the shore at depths determined with a depth finder. Three sinking gill nets were fished in the benthic zone (one gill net in each depth zone) for four net-nights per month. The pelagic zone was fished with a vertical gill net consisting of six 3 m by 30 m panels, each of a different mesh. The vertical gill nets were fished for four net-nights per month, during the ice-free season.

Locations to fish within each of the six zones were randomly selected, by placing a grid over a map of Harding Lake, and choosing a numbered grid with a random numbers table. When nets were retrieved, catches were separated by species, and each fish was measured to the nearest 1 mm of length.

Abundance of each species was subjectively classified as sparse, moderately abundant, or abundant based on the mean catch per net-night of fishing effort. Mean catch per effort was calculated by dividing the total catch of a species in a zone-month category by the total number of net nights of fishing effort in that category. The criteria used to separate these categories (Appendix A) was established based on the authors' best judgement of appropriate catches of each species for each category (Appendix A). For example, data collected in previous years has shown that least cisco are typically more abundant than lake trout, which are slow-growing and late-maturing. Thus, it is not unreasonable to assume that catches of six to 30 least cisco would be categorized as moderate for that species while catches of only two to six lake trout would be moderate, for that species. These abundance criteria are used only to provide some guidance in evaluating average catch per net-night.

RESULTS

Catches were generally low for most species in most zones. In the shallow littoral zone, northern pike were caught in every netting period that fishing effort was expended, although catches were low (Table 4). Other species caught periodically in the shallow littoral zone in 1990 were Arctic char,

Table 3. Typical fishing effort and gear used in each of the various ecological zones of Harding Lake.

Zone	Typical depth (m)	Gear	Typical fishing effort (Net-nights/month)
Shallow littoral	1	Fyke-traps ^a	16
Deep littoral	9	Gill-nets ^b	4
Shallow benthic	15	Gill-nets ^b	4
Moderate benthic	21	Gill-nets ^b	4
Deep benthic	27	Gill-nets ^b	4
Pelagic	0-30	Vertical gill-nets ^c	4

^a Fyke-traps were fished with a 25 m center lead anchored to shore and 7.5 m wings anchored perpendicular to the center lead.

^b Gill-nets used were 40 m by 2 m monofilament, variable mesh, sinking gill nets fished perpendicular to the depth contours. Depth of sets was determined with an electronic depth-finder.

^c Vertical gill-nets consisted of six 3 m by 30 m panels of multi-filament netting, each of a different mesh size, fished hanging vertically in the water column side by side.

Table 4. Catch per-unit-effort^a and relative index of abundance^b by species in the shallow littoral zone of Harding Lake during different sampling periods from 1987 to 1990.

Species	Mean catch-per-effort and index of relative abundance								
	June '87 (11 nn)	July '87 (15 nn)	Aug. '87 (9 nn)	July '88 (4 nn)	July '89 (2 nn)	June '90 (12 nn)	July '90 (16 nn)	Aug. '90 (16 nn)	Sept. '90 (16 nn)
Arctic char	0 ^c	0 ^c	0 ^c	0 ^c	0	0	0	0	3.75
Abundance index	---	---	---	sparse	sparse	sparse	sparse	sparse	moderate
Arctic grayling	0	0	0	0	0	0	0	0	3.44
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Burbot	0	0	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Lake trout	0	0	0	0	0	0	0	0	0.19
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Least cisco	0	0	0.11	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Northern pike	2.18	4.00	4.00	1.00	2.50	1.08	2.63	2.19	0.69
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Rainbow trout	0	0	0	0	0	0	0.13	0	15.31
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	moderate
Sockeye salmon	0	0	0	0	0	0	0.31	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Sheefish	0.36	0.13	0.11	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse

^a Catch-per-unit-effort was calculated as total catch during the sampling period divided by total effort during the sample period.

^b The methods and criteria used to develop index of relative abundance appear in the methods section and in Appendix B.

^c This species was not stocked and was not present in Harding Lake until after this sampling period was over.

lake trout, rainbow trout, and sockeye salmon. A few sheefish were caught in the shallow littoral zone during 1987, but failed to appear in any netting after August of 1987.

Catches were slightly higher in the deep littoral zone (Table 5). Arctic char were caught in the deep littoral zone during six of the eight sample periods that took place after Arctic char were first stocked in the lake in the summer of 1988. Lake trout were caught in every sample period in 1987 in the deep littoral zone, during one sample period in 1988, not caught in the zone in 1989, and caught during only one of four sample periods in 1990. Northern pike were caught in the deep littoral zone in nine out of 13 sample periods from 1987 through 1990. Rainbow trout and sockeye salmon were each caught in the deep littoral zone during only one sample period during the four years that netting occurred.

Several species were caught most frequently in the benthic zone (Table 6). Catches of Arctic char were more frequent and abundant in this zone than in any other zone of Harding Lake. Arctic char were caught at levels classified as moderate or abundant in seven of the last eight sample periods. Burbot and least cisco were also caught most frequently in the benthic zone, and each of these species were caught in 12 of 13 sample periods. Lake trout were most frequently caught in the benthic zone. Lake trout were caught in nine of the 13 sample periods.

Catches were low in the pelagic zone for all species except least cisco and burbot (Table 7). Least cisco were caught in all seven sample periods. Burbot were caught in six of the seven sample periods, and catch levels were classified as moderate during five of these sample periods.

Arctic char had the highest proportion of non-zero catches in the deep littoral and benthic zones. Of stocked species, Arctic char had the most sample periods with catches classified as moderate or abundant in the benthic zone. Arctic grayling were only caught on one occasion and that was in the shallow littoral zone. Burbot were most often caught in the benthic and pelagic zones. Lake trout were not caught in the pelagic zone and were seldom caught in the shallow littoral zone. Lake trout were caught most frequently in the benthic zone. Least cisco were usually caught in the deep littoral, benthic, and pelagic zones but rarely in the shallow littoral zone. Northern pike were always caught in the shallow littoral zone, usually caught in the deep littoral zone, not caught in the benthic zone, and periodically caught in the pelagic zone. Rainbow trout were not caught in the pelagic zone and were only caught in 1990 in the littoral and benthic zones. Sockeye salmon and sheefish were seldom caught. A detailed listing of catches by species, sample period, and zone is provided in Appendices B1 through B14.

DISCUSSION

Some species were not caught in some zones for behavioral reasons. Burbot, lake trout, and least cisco are typically deep water species. Northern pike and rainbow trout are typically captured in shallow water.

Table 5. Catch per-unit-effort^a and index of relative abundance^b by species in the deep littoral zone of Harding Lake during different sampling periods from 1987 to 1990.

Species	Mean catch-per-effort and index of relative abundance by species												
	June '87 (4 nn)	July '87 (4 nn)	Aug. '87 (3 nn)	Sept. '87 (1 nn)	June '88 (1 nn)	Sept. '88 (5 nn)	July '89 (3 nn)	Aug. '89 (1 nn)	Sept. '89 (1 nn)	June '90 (4 nn)	July '90 (4 nn)	Aug. '90 (4 nn)	Sept. '90 (4 nn)
Arctic char	0 ^c	0 ^c	0 ^c	0 ^c	0 ^c	0	0.67	1.00	43.00	0	1.75	3.75	2.50
Abundance index	---	---	---	---	---	sparse	sparse	sparse	abundant	sparse	sparse	moderate	moderate
Arctic grayling	0	0	0	0	0	0	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Burbot	0	0.25	0	0.25	0	0	0	0	0	0.25	0	0	0.75
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Lake trout	1.00	0.75	0.33	0.25	0	0.20	0	0	0	0	0	0.75	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Least cisco	6.00	25.25	5.00	3.75	30.00	5.00	3.33	0	0	3.75	22.50	10.50	1.25
Abundance index	sparse	moderate	sparse	sparse	moderate	sparse	sparse	sparse	sparse	sparse	moderate	sparse	sparse
Northern pike	1.75	1.25	3.33	4.25	0	1.40	0	0	4.00	2.25	0	0.25	0.25
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Rainbow trout	0	0	0	0	0	0	0	0	0	0	0	0	1.250
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Sockeye salmon	0	0	0	0	0	0	0	0	0	0	1.75	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Sheefish	0.36	0	0	0	0	0	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse

^a Catch-per-unit-effort was calculated as total catch during the sampling period divided by total effort during the sample period.

^b The methods and criteria used to develop index of relative abundance appear in the methods section and in Appendix B.

^c This species was not stocked and was not present in Harding Lake until after this sampling period was over.

Table 6. Catch-per-unit-effort^a and index of relative abundance^b by species in the benthic zone (shallow, moderate, and deep portions combined) of Harding Lake during different sampling periods from 1987 to 1990.

Species	Mean catch-per-effort & index of relative abundance												
	June '87 (12 nn)	July '87 (12 nn)	Aug. '87 (9 nn)	Sept. '87 (12 nn)	June '88 (3 nn)	Sept. '88 (15 nn)	July '89 (9 nn)	Aug. '89 (3 nn)	Sept. '89 (3 nn)	June '90 (8 nn)	July '90 (12 nn)	Aug. '90 (12 nn)	Sept. '90 (12 nn)
Arctic char	0 ^c	0 ^c	0 ^c	0 ^c	0 ^c	2.13	2.11	2.67	17.00	1.63	0.50	1.17	4.50
Abundance index	---	---	---	---	---	moderate	moderate	moderate	moderate	moderate	sparse	moderate	moderate
Arctic grayling	0	0	0	0	0	0	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Burbot	0.25	0.50	0.11	0.17	1.00	0.40	0.89	0	1.00	0.38	0.58	0.42	0.08
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Lake trout	0	0.17	0.89	0.42	0	0.40	0.22	0	0.33	0	0.08	0.25	0.33
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Least cisco	77.33	26.17	35.89	4.25	2.67	21.87	0.89	0.33	1.33	1.00	3.25	6.33	0
Abundance index	abundant	moderate	abundant	sparse	sparse	moderate	sparse	sparse	sparse	sparse	sparse	moderate	sparse
Northern pike	0	0	0	0	0	0	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Rainbow trout	0	0	0	0	0	0	0	0	0	0	0	0	0.08
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Sockeye salmon	0	0	0	0	0	0.07	0	0	0.33	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Sheefish	0.50	0	0	0	0	0	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse	sparse

^a Catch-per-unit-effort was calculated as total catch during the sampling period divided by total effort during the sample period.

^b The methods and criteria used to develop index of relative abundance appear in the methods section and in Appendix B.

^c This species was not stocked and not present in Harding Lake until after this sampling period was over.

Table 7. Catch-per-unit-effort^a and index of relative abundance^b by species in the pelagic zone of Harding Lake during different sampling periods from 1987 to 1990.

Species	Mean catch-per-effort and index of relative abundance						
	June '87 (4 nn)	July '87 (4 nn)	Aug. '87 (2 nn)	Sept. '87 (3 nn)	July '90 (4 nn)	Aug. '90 (4 nn)	Sept. '90 (4 nn)
Arctic char	0 ^c	0 ^c	0 ^c	0 ^c	0	0	6.25
Abundance index	---	---	---	---	sparse	sparse	sparse
Arctic grayling	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Burbot	0	0.50	2.00	1.33	2.75	3.25	1.25
Abundance index	sparse	sparse	moderate	moderate	moderate	moderate	moderate
Lake trout	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Least cisco	2.25	2.75	7.00	3.33	6.50	9.25	17.00
Abundance index	sparse	sparse	moderate	sparse	sparse	moderate	moderate
Northern pike	0	1.00	0	0	0	0.50	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Rainbow trout	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Sockeye salmon	0	0	0	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse
Sheefish	0.25	0	0.50	0	0	0	0
Abundance index	sparse	sparse	sparse	sparse	sparse	sparse	sparse

^a Catch-per-unit-effort was calculated as total catch during the sampling period divided by total effort during the sample period.

^b The methods and criteria used to develop index of relative abundance appear in the methods section and in Appendix B.

^c This species was not stocked and not known to reside in Harding Lake until after this sampling period was over.

The information presented in this report provides a general indication of trends in abundance and results of this study are being used to adjust the Harding Lake stocking regime. It is clear that several previous stocking efforts have failed. Failed stocking efforts include introductions of sheefish fingerlings and fry, sockeye salmon fry, Arctic grayling fingerlings and fry, and rainbow trout fingerlings and fry. These stockings are judged to have failed because significant numbers of fish did not appear in the sport fishery. The reasons that these stocking efforts did not succeed are not clear at this time. However, it seems likely that such enhancement efforts in the future would also fail.

This study provides tangible evidence that the continued stocking of Arctic char and rainbow trout as juveniles and/or adults may lead to fishable populations. Arctic char stocked as catchables have been the stocked species that has most frequently been caught in test netting. Success in catching Arctic char is thought to be due in part to their large size at stocking. In 1989, 0.3% of Arctic char stocked as juveniles and adults in 1988 and 1989 were reported harvested. In contrast, of more than 1.1 million rainbow trout fry and fingerlings stocked in Harding Lake in 1987, only 0.05% (529) were reported harvested in 1988 and 1989, when they would have been of catchable size. Thus, based on the results presented in this study, it is not thought that fish stocked at sizes under 10 g (fry and fingerlings) have done well in Harding Lake.

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LITERATURE CITED

- Clark, J. H. and M. Doxey. 1988. Abundance and length composition of sockeye salmon and least cisco in Pelagic waters of Harding Lake, Alaska, 1988. Alaska Department of Fish and Game. Fishery Data Series No. 76. Juneau, Alaska. 20 pp.
- Clark, J. H. 1991. Abundance, length, and age composition of sockeye salmon, Arctic char, and least cisco in pelagic waters of Harding Lake, Alaska, 1989 and 1990. Alaska Department of Fish and Game. Fishery Data Series No. 91-4. 25 pp.
- Doxey, M. 1991. A history of fisheries assessments and stocking programs in Harding Lake, Alaska 1939-1989. Alaska Department of Fish and Game. Fishery Manuscript.
- Merritt, M. F., A. Bingham, and N. Morton. 1990. Creel surveys conducted in interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-54. 125 pp.

LITERATURE CITED (Continued)

- Mills, M. J. 1987. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Fishery Data Series No. 2. 140 pp.
- _____. 1988. Alaska statewide sport fish harvest studies (1987). Alaska Department of Fish and Game. Fishery Data Series No. 52. Juneau, Alaska. 142 pp.
- _____. 1989. Alaska statewide sport fish harvest studies (1988). Alaska Department of Fish and Game. Fishery Data Series No. 122. 142 pp.
- _____. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-44. 152 pp.

APPENDIX A

Appendix A. Abundance criteria^a by species for mean catch-per-net-night.

Species	<u>Abundance category for mean catch per net-night:</u>		
	Sparse	Moderate	Abundant
Arctic char	0 to 1	> 1 to 6	more than 6
Arctic grayling	0 to 5	> 5 to 20	more than 20
Burbot	0 to 1	> 2 to 6	more than 6
Lake trout	0 to 1	> 2 to 6	more than 6
Least cisco	0 to 6	> 6 to 30	more than 30
Northern Pike	0 to 4	> 4 to 10	more than 10
Rainbow trout	0 to 5	> 5 to 20	more than 20

^a These criteria represent the arithmetic mean of values given by regional sport fish biologists for catches from a standard experimental gill-net.

APPENDIX B

Appendix B1. Catches from testnetting different zones^a of Harding Lake during June 1987.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Large	0	0	0	0	0	0
	Small	0	0	0	0	0	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Large	0	0	1	0	2	0
	Small	0	0	0	0	0	0
Lake trout	Large	0	4	0	0	0	0
	Small	0	0	0	0	0	0
Least cisco	All	0	24	104	321	503	9
Northern Pike	Large	19	0	0	0	0	0
	Small	5	7	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	0	0	0	0
Sheefish	Small	4	0	0	5	0	1
	Large	0	0	0	1	0	0
Total Catch		28	38	105	327	505	10
Fishing Effort (net-nights ^c)	11		4	4	4	4	4

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B2. Catches from testnetting different zones^a of Harding Lake during July 1987.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Large	0	0	0	0	0	0
	Small	0	0	0	0	0	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Large	0	1	5	1	1	2
	Small	0	0	0	0	0	0
Lake trout	Large	0	3	1	1	0	0
	Small	0	0	0	0	0	0
Least cisco	All	0	101	142	65	107	11
Northern Pike	Large	50	5	0	0	0	4
	Small	10	0	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	0	0	0	0
Sheefish	Small	1	0	0	0	0	0
	Large	1	0	0	0	0	0
Total Catch		62	110	148	67	108	17
Fishing Effort (net-nights ^c)	15		4	4	4	4	4

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B3. Catches from testnetting different zones^a of Harding Lake during August 1987.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Large	0	0	0	0	0	0
	Small	0	0	0	0	0	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Large	0	0	0	0	1	4
	Small	0	0	0	0	0	0
Lake trout	Large	0	1	7	1	0	0
	Small	0	0	0	0	0	0
Least cisco	All	1	15	13	205	105	14
Northern Pike	Large	33	10	0	0	0	0
	Small	3	0	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	0	0	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	1	0	0	0	0	1
Total Catch		38	26	20	206	106	19
Fishing Effort (net-nights ^c)		9	3	3	3	3	2

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B4. Catches from testnetting different zones^a of Harding Lake during September 1987.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Large	0	0	0	0	0	0
	Small	0	0	0	0	0	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Large	0	1	1	1	0	4
	Small	0	0	0	0	0	0
Lake trout	Large	0	1	3	2	0	0
	Small	0	0	0	0	0	0
Least cisco	All	0	15	8	31	12	10
Northern Pike	Large	0	17	0	0	0	0
	Small	0	0	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	0	0	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		0	34	12	34	12	14
Fishing Effort (net-nights ^c)		0	4	4	4	4	3

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B5. Catches from testnetting different zones^a of Harding Lake during June 1988.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	0	0	1	2	0
Lake trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Least cisco	All	0	30	0	3	5	0
Northern Pike	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	0	0	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		0	30	0	4	7	0
Fishing Effort (net-nights ^c)		0	1	1	1	1	0

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B6. Catches from testnetting different zones^a of Harding Lake during July 1988.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Lake trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Least cisco	All	0	0	0	0	0	0
Northern Pike	Small	11	0	0	0	0	0
	Large	0	0	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	0	0	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		11	0	0	0	0	0
Fishing Effort (net-nights ^c)		4	0	0	0	0	0

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B7. Catches from testnetting different zones^a of Harding Lake during September 1988.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	0	0	1	2	0
	Large	0	0	0	12	17	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Small	0	0	0	0	2	0
	Large	0	0	1	2	1	0
Lake trout	Small	0	0	0	0	0	0
	Large	0	1	4	2	0	0
Least cisco	All	0	20	25	159	144	0
Northern Pike	Small	0	0	0	0	0	0
	Large	0	7	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	1	0	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		0	28	31	176	166	0
Fishing Effort (net-nights ^c)		0	5	5	5	5	0

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B8. Catches from testnetting different zones^a of Harding Lake during July of 1989.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	1	0	0	0	0
	Large	0	1	2	4	13	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	0	1	3	4	0
Lake trout	Small	0	0	0	0	0	0
	Large	0	0	2	0	0	0
Least cisco	All	0	10	4	1	3	0
Northern Pike	Small	1	0	0	0	0	0
	Large	4	0	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		5	12	9	8	20	0
Fishing Effort (net-nights ^c)		2	3	3	3	3	0

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B9. Catches from testnetting different zones^a of Harding Lake during August of 1989.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	0	3	1	2	0
	Large	0	1	0	1	1	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Lake trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Least cisco	All	0	0	1	0	2	0
Northern Pike	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		0	1	4	2	5	0
Fishing Effort (net-nights ^c)		0	1	1	1	1	0

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B10. Catches from testnetting different zones^a of Harding Lake during September 1989.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	20	0	1	0	0
	Large	0	23	27	15	8	0
Arctic grayling	All	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	0	0	3	0	0
Lake trout	Small	0	0	0	0	0	0
	Large	0	0	0	1	0	0
Least cisco	All	0	0	1	1	2	0
Northern Pike	Small	0	1	0	0	0	0
	Large	0	3	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	All	0	0	0	1	0	0
Sheefish	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		0	47	28	22	10	0
Fishing Effort (net-nights ^c)		0	1	1	1	1	0

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B11. Catches from testnetting different zones^a of Harding Lake during June of 1990.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	0	0	0	0	0
	Large	0	0	4	9	0	0
Arctic grayling	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	1	2	1	0	0
Lake trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Least cisco	Small	0	15	0	8	0	0
	Large	0	0	0	0	0	0
Northern Pike	Small	3	0	0	0	0	0
	Large	10	9	0	0	0	0
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		13	25	6	18	0	0
Fishing Effort (net-nights ^c)		12	4	4	4	0	0

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B12. Catches from testnetting different zones^a of Harding Lake during July of 1990.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	0	0	0	0	0
	Large	0	7	3	3	0	0
Arctic grayling	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	0	3	3	1	11
Lake trout	Small	0	0	0	0	0	0
	Large	0	0	0	1	0	0
Least cisco	All	0	90	23	8	8	26
Northern pike	Large	25	0	0	0	0	0
	Small	17	0	0	0	0	0
Rainbow trout	Large	0	0	0	0	0	0
	Small	2	0	0	0	0	0
Sockeye salmon	All	5	7	0	0	0	0
Total Catch		49	97	29	15	9	37
Fishing Effort (net-nights ^c)		16	4	4	4	4	4

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B13. Catches from testnetting different zones^a of Harding Lake during August of 1990.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	0	0	1	0	1	0
	Large	0	15	4	6	2	0
Arctic grayling	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	1
	Large	0	0	0	3	2	12
Lake trout	Small	0	0	0	0	0	0
	Large	0	3	3	0	0	0
Least cisco	Small	0	42	23	28	25	37
	Large	0	0	0	0	0	0
Northern Pike	Small	15	0	0	0	0	0
	Large	20	1	0	0	0	2
Rainbow trout	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Sockeye salmon	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		35	61	31	37	30	52
Fishing Effort (net-nights ^c)		16	4	4	4	4	4

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

Appendix B14. Catches from testnetting different zones^a of Harding Lake during September of 1990.

Species	Size ^b	Zone					
		Littoral		Benthic			Pelagic
		Shallow (1 m)	Deep (10 m)	Shallow (15 m)	Moderate (21 m)	Deep (27 m)	(0-30 m)
Arctic char	Small	59	2	3	5	13	20
	Large	1	8	9	8	16	5
Arctic grayling	Small	55	0	0	0	0	0
	Large	0	0	0	0	0	0
Burbot	Small	0	0	0	0	0	0
	Large	0	3	1	0	0	5
Lake trout	Small	3	0	0	0	0	0
	Large	0	0	0	3	1	0
Least cisco	Small	0	5	0	0	0	68
	Large	0	0	0	0	0	0
Northern Pike	Small	2	0	0	0	0	0
	Large	9	1	0	0	0	0
Rainbow trout	Small	36	0	0	0	0	0
	Large	209	5	0	0	1	0
Sockeye salmon	Small	0	0	0	0	0	0
	Large	0	0	0	0	0	0
Total Catch		374	24	13	16	31	98
Fishing Effort (net-nights ^c)	16		4	4	4	4	4

^a Zones were fished as follows: a fyke trap with a 25 m center lead and 7.5 m wings anchored from shore for shallow littoral; a 40 m, sinking, variable mesh, monofilament gill-net for deep littoral; a 40 m, sinking, variable mesh, monofilament gill-net for shallow benthic; a 40 m, sinking, variable mesh, monofilament gill-net for moderate benthic; a 40 m, sinking, variable mesh, monofilament gill-net for deep benthic; a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

^b Fish sizes are defined as follows: small = less than 200 mm TL and large = greater than 199 mm TL for Arctic char and rainbow trout; small = less than 300 mm TL and large = greater than 299 mm TL for northern pike, burbot, and lake trout. All Arctic grayling and sockeye salmon caught were less than 200 mm TL.

^c A net-night is defined as approximately a 24 hour set of a fyke trap in the shallow benthic zone, a 24 hour set of a 40 m, sinking, variable-mesh, monofilament, experimental gill net in the benthic zones, and a 24 hour set of a vertical gill net consisting of six 3 m x 30 m panels (each a different mesh size) of multi-filament gill net in the pelagic zone.

